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Olivier Rayssac

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WINSTON & STRAWN LLP

PATENT DEPARTMENT

1700 K STREET, N.W.

WASHINGTON, DC 20006

EXAMINER

TRINH, MICHAEL MANTH

ART UNIT

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2822

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/775,917

Applicant(s)

RAYSSAC ET AL.

Examiner

Michael Trinh

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11/5/08 & 10/16/08.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5,8-14, 16-18 and 21-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5,8-14, 16-18 and 21-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

*** This office action is in response to Applicants' Amendment filed May 05, 2008. Claims 1-5,8-14,16-18,21-24 are pending.

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

1. Claims 1-5,8-14,16-18,22-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

** Re base claim 1: Base claim 1 recites "repeating...if necessary until...for constituting a self-supported thin layer...". However, it is indefinite for when to perform the repeating step and for when to stop the step of "repeating...if necessary until...", since the "self-supported thin" is relative and indefinite for how thin of it. Also, it is vague for how to definitely determine when the layer is "self-supported thin".

(Other dependent claims are also rejected as depending on rejecting indefinite base claim 1, except claim 21) .

** Re further claim 3: Claim 3 recites "...further providing the at least one electronic component...prior to the implanting of the atomic species, with the thin layer supporting..." is indefinite, since "...the thin layer" lacks proper antecedent basis with indefinite of relative term of "thin". Moreover, base claim 1 already has the at least one electronic component prior to the implantation (thus, claim 3 also appears not further limit base claim 1).

Claim Rejections - 35 USC § 103

2. Claims 1-4,8-11,16-18,22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al (6,191,007) taken with Aspar et al (6,103,597) and Tayanaka (6,107,213).

Re claim 1, Matsui teaches (at least in Figs 22; col 34, line 57 through col 35; Figs 1-23,34; cols 12-28; Figs 17A-17C, col 28, line 55 to col 31) method of providing a self-supporting electronic component or circuit on a thinned supported formed by thinning a wafer

made of semiconductor material, which comprises: providing the wafer (118 in Fig 22) having a first face supporting at least one electronic component or circuit that is apparently exposed (115/114b in Figure 22; 225/223 in Fig 34; 2,3 in Figs 1-4; col 12, lines 1-35), the wafer having an opposing second back face; implanting atomic species through the second back face (Figure 22) and into the wafer without passing through the electronic component to obtain a zone 120 of weakness at a predetermined depth therein (Fig 22, col 34, line 57 through col 35; col 28, lines 38-52; col 34, lines 25-55), the zone defining a first portion of the wafer extending from the zone to the first face and at a thickness sufficient to self-support the electronic component or circuit, when using a general implant apparatus for implanting the atomic species, with a remaining portion constituted by the remaining portion of the wafer; removing the remaining portion from the first portion along the zone of weakness to thin the wafer to the self-supporting thickness, with the electronic components or circuit (e.g. 115 in Fig 22) remaining apparently exposed on the first face (Figs 22,2C,3C,21-22), to provide a new second face opposite the first face on the first portion, and wherein as the electronic component or the circuit is supported by the self-supported thin layer, it is not necessary to perform the last step of repeating the implanting and removing steps until the first portion has a reduced thickness for constituting a self-supported thin layer for the apparent exposed electronic component (Fig 22) or circuit supported on the first face. Re further claim 2, thinning the wafer by a mechanical polishing method is prior to the implanting of the atomic species (col 35, lines 21-28). Re claim 3, Matsui also teaches providing at least one electronic component or circuit (115 in Fig 22; 225/223 in Fig 34; 2,3 in Figs 1-4; col 12, lines 1-35) on the first face of the wafer prior to the implanting of the atomic species. Re claim 4, wherein the remaining portion of the wafer is removed by applying a heat treatment (col 13, lines 60 through col 14). Re claim 8, wherein the stiffener is formed by deposition (col 12, lines 40-48), wherein the stiffener (Fig 2C; 6,8,5) is applied to the second face of the wafer 1 prior to removing the remaining portion by the application of a heat treatment (col 12, lines 40 through col 13; col 13, line 60 through col 14). Re claim 9, wherein the stiffener 5 comprises a layer of silicon oxide (col 12, lines 35-48; Fig 2C). Re claim 10, wherein the stiffener 8,5,6 comprises a rigid plate (col 12, line 35 through col 13; col 25, lines 23-25). Re claim 11, wherein the rigid plate comprises a monocrystalline (col 13, lines 25-32) or polycrystalline silicon material (col 12, lines 40-48). Re claim 16, wherein the wafer comprises silicon (col 11,

line 65 through col 12, line 8). Re claim 17, wherein the wafer comprises a silicon on insulator wafer (col 11, lines 60-65; col 35, lines 60-67; col 17, lines 29-50). Re claim 18, wherein the wafer comprises germanium, an alloy of silicon and germanium, silicon carbide (col 64, lines 49-56). Re claim 22, wherein the zone of weakness defines the remaining portion extending therefrom to the second face (Figs 22,17). Re claim 23, wherein the first portion (e.g. the first portion 117, as shown in Figures 22,17D) comprising a self-supported portion between the electronic component or circuit (115 in Fig 22; 225/223 in Fig 34; 2,3 in Figs 1-4; col 12, lines 1-35) and the zone of weakness, and the electronic component or circuit is supported on the self-supported portion during and after the removal. Re claim 24, wherein the electronic component or circuit(115 in Fig 22; 225/223 in Fig 34; 2,3 in Figs 1-4; col 12, lines 1-35) has opposing first and second sides, with the second side being supported on the self-supported portion (e.g. the first portion 117, as shown in Figures 22,17D) during and after the removal.

Re claim 1, Matsui lacks applying a stiffener to a second face prior to the removing step to thin the wafer with the electronic component or circuit remaining exposed on the first face.

However, Tayanaka teaches (at Figs 3B-3C; col 15, lines 22-45) applying a stiffener 15/14 to both first and second faces of the wafer prior to removing the remaining portions, and then removing the stiffener and the remaining portion from the first portion. Aspar et al '597 teach (at col 7, lines 21-26; Figs 1-5, col 6, line 10 to col 7, line 36) that "in the case where the thickness of the thin film of semiconductor material is sufficiently great to have satisfactory rigidity, *the presence of a rigid support is not necessary...*" (col 7, lines 21-26; col 6, lines 24-50; Figs 1-5), wherein since the rigid support is not necessary, the electronic component or the circuit remaining exposed on the first face.

Therefore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to form a thin electronic device layer of Matsui by applying at least a stiffener to a second face of the wafer prior to removing the remaining portions and the stiffener from the first portion to thin the wafer with the electronic component or circuit remaining exposed on the first face, as taught by Tayanaka and Aspar '597, wherein since the rigid support is not necessary, the electronic component or the circuit remaining exposed on the first face. This is because of the desirability to facilitate the step of thinning of the wafer by removing the remaining portions, wherein the stiffeners cover and protect both second and first

faces of the wafers during separation, wherein in the case where the thickness of the thin film of semiconductor material is sufficiently great to have satisfactory rigidity, the presence of a rigid support is not necessary, and, accordingly, the electronic component or the circuit remaining exposed on the first face.

3. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al (6,191,007) taken with Aspar et al (6,103,597) and Tayanaka (6,107,213), as applied to claims 1-4,8-11,16-18,22-24 above, and further of Hanson et al (5,920,764).

The relied references of Matsui, Aspar '597 and Tayanaka teach method of providing a self-supporting electronic component or circuit on a thinned supported formed by thinning a wafer made of semiconductor material, as applied to claims 1-4,8-11,16-18,22-24 above, and fully repeated herein.

Re claim 21, Matsui also already teaches removing the remaining portion as a self-supporting layer having a thickness of less than 35 micron from the first portion along the zone of weakness to thin the wafer (10 microns to several tens of microns at col 62, lines 1-8; 1-47; Fig 64D; 0.1 to 2 microns at col 15, lines 11-20).

Re claim 21, Matsui thus lacks repeating the implanting and removing steps until the first portion having a reduced thickness.

However, Hanson teaches (at Figs 4-5,3,1; col 4, lines 37-40; col 1, line 1 through col 2; col 4, line 6 through col 5) performing a Smart-Cut process by implanting hydrogen into the wafer to form a zone of weakness, and removing the portion to thinning the wafer, wherein, if required, the process of implantation, heating, and fracture can be repeated until the desired thickness are removed so as to retain a wafer having reduced thickness (col 4, lines 37-40).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to thinning a wafer made of a semiconductor material of the relied references including Matsui by repeating the implanting and removing steps until the desired thickness are removed first portion has a reduced thickness, if required and if necessary, the process of implantation, heating, and fracture can be repeated until the desired thickness are removed, as taught by Hanson. This is because of the desirability to thinning and reduce a wafer

having a desired thickness so that a thin wafer and small semiconductor devices can be fabricated.

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al (6,191,007) taken with Aspar et al (6,103,597) and Tayanaka (6,107,213), as applied to claims 1-4,8-11,16-18,22-24 above, and further of Henley (6,291,314).

The relied references including Matsui, Aspar '597, and Tayanaka teach a method of providing a self-supporting electronic component or circuit on a thinned supported formed by thinning a wafer made of semiconductor material, as applied to claims 1-4,8-11,16-18,22-24 above, and fully repeated herein.

Re claim 5, the relied references including Matsui already teach removing the remaining portion of the wafer by heating (Matsui at col 13, lines 60 through col 14).

Re claim 5, the relied references including Matsui lack removing by blowing a jet of fluid adjacent the zone of weakness.

However, Henley teaches (at Fig 14; col 19, line 51 through col 21) removing the remaining portion by heating or blowing a jet of fluid adjacent the zone of weakness (col 20, 62 through col 21; col 20, lines 35-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to removing the remaining portion of the wafer of the relied references including Matsui by heating or blowing a jet of fluid adjacent the zone of weakness, as taught by Henley, because these removing techniques are alternative and art recognized equivalent methods for removing a portion of the wafer in an effective and reliable manner.

5. Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al (6,191,007) taken with Aspar et al (6,103,597) and Tayanaka (6,107,213), as applied to claims 1-4,8-11,16-18,22-24 above, and further of Aspar et al (6,020,252) and Sayyah (2002/0055237).

The relied references including Matsui, Aspar '597, and Tayanaka teach a method of providing a self-supporting electronic component or circuit on a thinned supported formed by thinning a wafer made of semiconductor material, as applied to claims 1-4,8-11,16-18,22-24 above, and fully repeated herein.

The relied references already teach applying a stiffener comprising a rigid plate 8,5,6 (Matsui, col 12, line 35 through col 13; col 25, lines 23-25), but lack to use a stiffener comprising a flexible film (claim 12) or an adhesive film (claim 13), a wax layer (re claim 14).

However, Aspar '252 teaches (at col 6, lines 6-39; Figs 3-4) applying a stiffener 8 comprising a rigid or flexible support (re claim 12), wherein the stiffener comprises an adhesive film (claim 13, col 6, lines 12-18). Tayanaka also teaches forming the stiffener 14/15 comprising a flexible support 15 including an adhesive layer 14 (Figs 3B-3C; col 15, lines 23-40). Sayyah also teaches (at Figs 1c-1g; col 1, paragraphs 6,34-36) using a release stiffener layer comprising an adhesive or a wax layer (paragraph 0006).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove a portion of the wafer of the references including Matsui by applying a stiffener on the substrate, wherein applying a stiffener 8 comprising a rigid or flexible support, wherein the stiffener comprises an adhesive film (col 6, lines 12-18), as taught by Aspar '252 and Tayanaka, wherein using an adhesive or a wax layer is further taught by Sayyah. This is because these stiffeners of rigid or flexible and adhesive or wax layers are alternative and art recognized equivalent materials that can be effectively used as a support and release layer during the step of removing a portion of the wafer.

Response to Amendment

6. Applicant's remarks filed October 16, 2008 have been fully considered but they are not persuasive, and in view of the new ground(s) of rejection.

Applicant remarked that "...Matsui bonds the device to a support and then transfers..." and "...keeps the electronic component or circuit remaining on the original face of the original wafer, is not disclosed or suggested in Matsui".

In response, it is noted and found unconvincing. In the combination of the references including Matsui and Aspar (6,103,597), Aspar '597 clearly (at col 7, lines 21-26; Figs 1-5, col 6, line 10 to col 7, line 36) that where the thickness of the thin film of semiconductor material is sufficiently great to have satisfactory rigidity, *the presence of a rigid support is not necessary* (col 7, lines 21-26; col 6, lines 24-50; Figs 1-5), wherein since the rigid support is not necessary, the electronic component or the circuit remaining exposed on the first face. Thus, the rejection is

not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference. In *Re Lyons* 150 USPQ 741 (CCPA 1966). Moreover, it is well settled that one can not show non-obviousness by attacking the references individually where, as here, the rejection is based on combinations of references. In *Re Keller*, 208 USPQ 871 (CCPA 1981); In *Re Young*, 159 USPQ 725 (CCPA 1968).

In the combination, the electronic component patterns 115 of Matsui were formed on the first face (i.e. the electronic component patterns 115 were formed on the first face of the layer 114a of the wafer substrate; see Figs. 22, 17C-17D) and still remained on that first face of the remaining thin wafer after splitting. Again, claimed subject matter, not the specification, is the measure of invention. Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In *Re Self*, 213 USPQ 1,5 (CCPA 1982); In *Re Priest*, 199 USPQ 11,15 (CCPA 1978).

Applying a stiffener as taught by Tayanaka would have been obvious because at least of the desirability to facilitate the removal or cleaving of the weak zone. Herein, Tayanaka clearly teaches (at Figs 3B-3C; col 15, lines 22-45) applying a stiffener 15/14 to both first and second faces of the wafer prior to removing the remaining portions, and removing the stiffener and the remaining portion from the first portion. The test for combining references is what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In *re McLaughlin* 170 USPQ 209 (CCPA 1971); In *Re Rosselet* 146 USPQ 183 (CCPA 196). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. In *Re Simon*, 174 USPQ 114 (CCPA 1972); In *Re Richman* 165 USPQ 509, 514 (CCPA 1970).

Matsui clearly teaches the claimed invention by removing the remaining portion of the wafer to reduced its wafer thickness so as to provide a self-supporting thin wafer with a thickness of less than 35 micron from the first portion along the zone of weakness, wherein the thinning wafer after reducing its thickness has a reduced thickness of about 10 microns to several tens of microns (see column 62, lines 1-8; 1-47; Fig 64D; with 0.1 to 2 microns at col 15, lines 11-20 ("several" is defined as being more than two or three but not many). This thinner wafer after thinning and reducing its thickness together with circuit layers on its first face is constituting a self-supported thin layer for the electronic component circuit formed thereon.

Hanson et al reference teaches repeating the Smart-Cut process by implanting hydrogen into the wafer to form a zone of weakness at a certain depth (about 5000 Angstroms to 3 μm), and removing the portion to thinning the wafer, wherein, if required, the process of implantation, heating, and fracture can be repeated until the desired thickness are removed so as to retain a wafer having reduced thickness (col 4, lines 37-40; Figs 4-5,3,1; col 4, lines 37-40; col 1, line 1 through col 2; col 4, line 6 through col 5). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to thinning a wafer made of a semiconductor material of Matsui by repeating the thinning process until the desired thickness are obtained, as taught by Hanson, if required and if necessary. This is because of the desirability to thinning and to reduce the wafer thickness until the desired thickness are obtained so that thinner and smaller semiconductor devices can be fabricated. The primary reference of Matsui clearly teaches forming at least one electronic component or circuit (115 in Fig 22; 225/223 in Fig 34; 2,3 in Figs 1-4; col 12, lines 1-35) on the first face of the wafer. In Matsui, the semiconductor wafer is having a thickness of about a few hundred micrometers (col 35, lines 12-28); and thus, in view of Hanson, repeating the implanting and removing step would have been obvious to one of ordinary skill in the art in order to reduce the thickness of the wafer to have a desired thickness, wherein just after the first splitting and removing step, the first portion the wafer having a reduced thickness also constitutes a self-supported thin layer for the electronic component or circuit supported on the first face. Thus, the rejection is not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference. In Re Lyons 150 USPQ 741 (CCPA 1966). Moreover, it is well settled that one can not show non-obviousness by attacking the references individually where, as here, the rejection is based on combinations of references. In Re Keller, 208 USPQ 871 (CCPA 1981); In Re Young, 159 USPQ 725 (CCPA 1968).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 9:00 Am to 5:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number is (571) 273-8300.

Art Unit: 2822

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).
Oacs-17

/Michael Trinh/

Primary Examiner, Art Unit 2822